

## A STUDY IN INSECT PROTECTION

(*ANOPLOCNEMIS PHASIANA*, FABR.)

BY

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(*With two plates*)

The scheme of Nature is so closely knit ; all living things are so dependent on one another that many and varied schemes have been devised for maintaining existence in the contest for life. One animal has gone in for cryptic coloration, another for some type of offensive weapon, another for some artful method of escape ; then others have taken to the ruse of mimicry, others to the development of nauseous juices, others to the emission of noxious fumes. And so on, ruse after ruse. In nothing has Nature shown more ingenuity than in the creation of protective schemes.

But the point which I wish to make here is that we often find in the same species not merely one of these protective devices, but rather a combination of several devices on the interaction of which its existence depends. These devices may exist at the same time, or may follow one another as the creature develops. But in either case, whether simultaneous or successive, each device has its function to fulfil at some particular place or time. Let us, therefore, consider one species of insect, a conspicuous example with a simple history, and observe its manner of dealing with this problem at successive stages of growth. We will not delay on anatomical development. It has not the interest to the field observer that have instincts and living acts.

The species in question is *Anoplocnemis phasiana*, a large bug, repulsive in appearance, which may sometimes be seen on young foliage after the rains have set in. Different kinds of vegetation attract it ; but its favourite plants in Central India are *Cassia occidentalis* and *Ægle marmelos*. It is a stout insect, black throughout, except for some yellow near the tips of its antennæ, and on its back an orange patch which is ordinarily hidden by the closed wings. It possesses a peculiar geometrical appearance, as though built on some cubist plan. (See Plate 1, Fig. 5.) Its thorax is a sloping equilateral triangle ; its abdomen is isosceles in shape. Its wings, owing to the way in which they overlap, make a pattern of geometrical figures on its back. But look at its hind legs. They are very extraordinary. Those of the female show nothing in particular, but in the male they are distended into clubs and furnished with a strong tooth. On the whole we have an insect of grotesque appearance, repulsive by reason of its black colour and the extravagant conformation of its parts.

Let us pass to its development and growth. In July I see the sexes in union. It is a prolonged affair, without much enthusiasm, and takes place on the terminal shoots of a plant. Eggs are laid and spread along a stem. They are elongated cushions, convex above, but hollowed beneath so as to fit around the stem. Their number varies. In one clutch I count eight; in another nineteen. Their position, however, is always the same, a string of cushions touching one another, each about one-tenth of an inch long. (See Plate I, Fig. 1.)

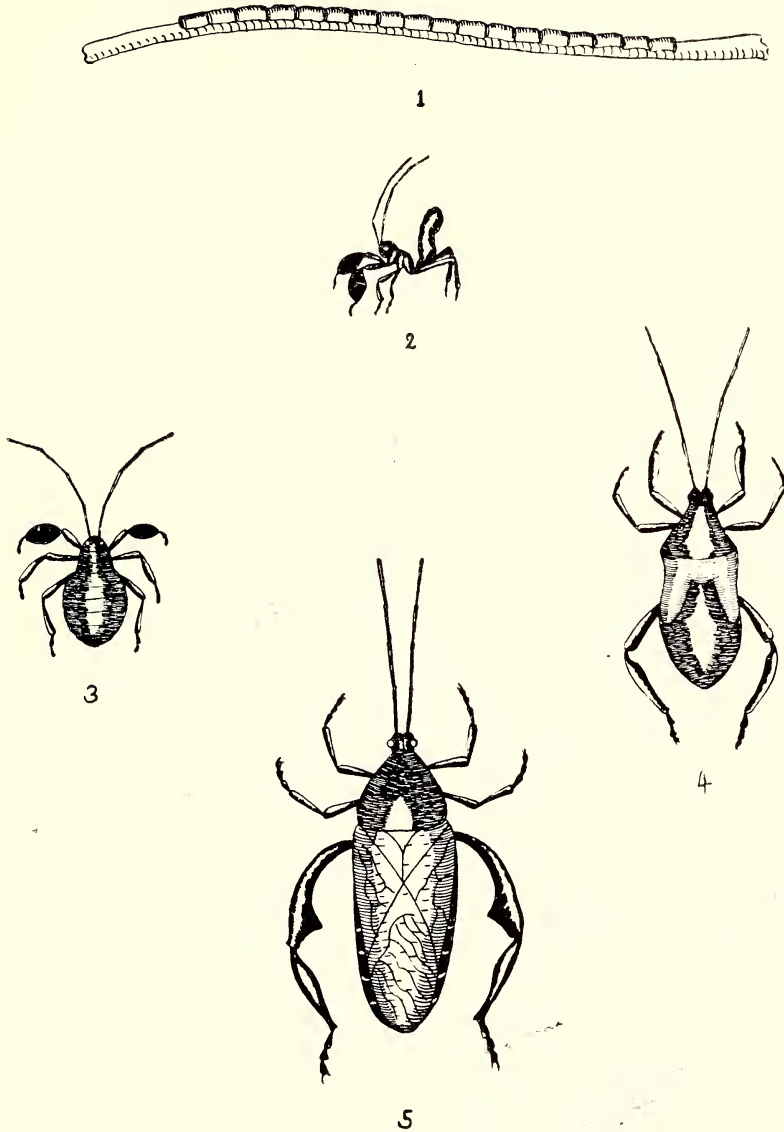
The casing of the egg is dark brown, delicately mottled, particularly at the sides, with a dash of silver grey. In this we have the first of our devices for protection. The eggs are mottled to harmonize with the stem; furthermore their arrangement in linear series helps to bring about the same effect. Though freely exposed, they blend well with their support; at most they look like a simple swelling along the line of the brown stem. Hence we have the ruse of protective coloration at the earliest stage of the insect's life.

Let us continue. Within the hard capsule of the egg a minute creature assumes shape. Its development occupies ten days. Then a breach occurs in the shell, a circular aperture at one extremity, so perfect that it might have been made with a punch. Through this gate of exit the little inmate emerges. First one egg opens, then another; until the whole family is born.

*Anoplocnemis* at birth is a spider-like object, absolutely black except for a stripe transversely across the middle of its back. Its tiny body is flat and triangular; its legs are spread around it in a cluster; its antennæ are held erect in the air. As a rule it remains still, but, if alarmed, it runs about with antennæ swaying and abdomen raised. The creatures are social at this period of their life. The family tries to keep together, the members employing their long sensitive antennæ for the purpose of maintaining touch. Soon after birth it begins to feed. It has a long beak like a straight lance. This it pushes into the plant. Through it sap is drawn to the mouth and life's continuous gorge begins.

The next event is the casting of its skin, which takes place on the fourth or fifth day. The superficial integument is shed, and out comes the bug in a new dress. Though larger in size, it is little changed in appearance, being still the same jet black colour. Its legs have the same spider-like appearance. One thing, however, we do begin to notice. The tibiæ on the front pair of legs are flattening into a pair of blades. Also we observe that it is less socially inclined. The family shows signs of scattering. Individuals wander away on their own and collect in twos and threes on various tender shoots.

The second moult accentuates these changes. The insect is now distinctly bigger. Also it is one of the most illshaped little creatures that one could anywhere expect to see (See Plate I, Fig. 2). In length about quarter of an inch, it is absolutely black save for bands on the antennæ and a pale line across the middle of its waist. Its gait is awkward and attitude unnatural. Its long antennæ are held erect; its abdomen hoisted; its fore legs, dilated into flattened plates, are thrust out conspicuously in front. It gives out a slightly



DEVELOPMENT OF *Anoplocnemis phasiana*.

- 1 Line of eggs affixed to stem.
- 2 Insect after second moult.
- 3 Insect after third moult.
- 4 Insect after fifth moult.
- 5 Mature insect.



*Anoplocnemis* in gun-firing attitude.

unpleasant odour, a foretaste of the foul effluvium which develops at a later date. All in the family have now scattered. Singly they crawl from shoot to shoot, their queer-shaped bodies apparently well fitted to the slow paces of their ill-proportioned legs. Like so many devilkings they stalk about, looking as if out of place in this creation, and more fitted to some prehistoric life.

Now what is the reason for this strange conformation? I regard it as the second of the devices used by this creature for its defence. The raising of the abdomen and the dilatation of the front legs are the points which concern us here. Why do these exist? The hoisting upward of the abdomen is certainly protective. Many poison-squirting insects habitually do it, for instance different species of ants. *Cremastogaster* ants are specially instructive, for when other ants are near them when they raise their abdomens, the other ants immediately rush off. What raising of the abdomen implies to an enemy is the danger of a poison squirt. Now, the bug, at this stage, possesses no poison. What then does it do? It mimics the poison-squirting movement. It gives an enemy the false impression of having a poison jet.

A brief digression may be instructive. Are there any other creatures in my district which employ the same deceitful plan? I will mention a few. Rove-Beetles abound at the margin of the river. They are elongated insects with stunted wings. Alarm one of them, and see what happens. Up goes its abdomen into the air after the manner of poisonous ants. Rove-Beetles, of course are perfectly innocent. The hoisting act is pure deceit. Here is another instance. A Tabanid fly, *Gastroxides ater*, used to visit the tree-trunks in my garden. It was about as large as a bluebottle and conspicuously marked with an orange coloured band. Alarm it, and what did it do? Not fly away like an ordinary bluebottle. It raised its abdomen over its back, then elevated and depressed the erected point like a wasp when protruding and drawing in its sting. Again another deceitful business, for the fly has not a trace of a sting. Moreover, it seemed to know the value of its ruse. It was unusually careless of intrusion. I could even stroke its body while it tilted its abdomen into the air.

Now for the flattening of the front legs. Why is this? It is another of these simulating devices. Raptorial insects, which clutch hold of their victims, often have their front legs flattened into blades that are armed with sharp teeth. *Anoplocnemis* has no armoury of teeth, but the flattening into blades is distinctly marked. Moreover, it thrusts them out in front, the attitude which raptorial insects assume. Hence we have another of these simulating devices. The insect is really perfectly harmless, but it looks the very essence of evil and danger. By hoisting the abdomen it pretends to be poisonous; by having flattened front legs it pretends to be raptorial. It is nothing but a bundle of deceit.

But in addition to these simulating ruses the creature has still another method of securing protection from attack. I often find it on the foliage of the Bael tree with its spear stuck in the youngest shoots. It sucks up the sap. The leaves wither, then droop in a shrivelled cluster and end by getting absolutely black. The bug,

however, remains beneath the cluster and keeps on draining at the sap. Now, the leaves in this withered state, are exactly the same black colour as the bug; moreover, they droop in an unsymmetrical cluster like the shapeless conformation of its body and limbs. Also some of the leaves are tiny, and the smallest of them are exactly the same shape as the insect's dilated legs. The cluster is therefore a vegetable shield beneath which the insect is hidden from view. Nor must it be thought that the occurrence is just casual. On the contrary, it is the habit of the creature to get under this canopy of blackened leaves. Here then we have still another device. The bug, through its own sucking operations, constructs for itself a vegetable canopy, which canopy helps to protect it by blending with its colour and shape.

Let us proceed. Its development continues. A third moult occurs, the transformation taking place underneath the black canopy where the insect is comparatively safe. The creature is now larger, five-sixteenths of an inch long, and still the same flattened shape. (See Plate 1, Fig. 3). The dilatations on the front legs are somewhat smaller; on the back of its abdomen are two small pores that were scarcely visible at the earlier stage. The ruse of erecting the abdomen has gone. The insect has become much more sluggish. It remains for a long time stuck to a shoot, sucking at it till the leaves are completely dry. In fact it is changing into a sucking-machine, with no business in life but to drain out sap, and no other event in its monotonous existence beyond the periodical shedding of its skin.

I have said that two small pores appear on its back. What are these? Still another of this insect's defensive methods. They are apertures of exit for nauseous juice.

A fourth moult shows further changes. The dilated front legs have practically gone. The body is growing more in length. Stumps, which represent future wings, are developing along its back. It has got too large to hide beneath a canopy. Some other kind of defence is needed. So conspicuous a creature must have some kind of ruse to protect in on the open leaves. The new ruse is the pair of pores which shoot out a disgusting juice. Also it has taken to another device, that of falling to the ground the instant anything touches its stem.

A fifth moult brings out still larger wings. A double pair are quite distinct, upper ones, large and conspicuous; lower ones tucked in underneath. The dilated front legs have completely disappeared. All the devilkin appearance is lost. (See Plate 1, Fig. 4.)

The sixth moult gives us the mature insect. The event is one of considerable change. Hitherto we have had a gradual transition; this is like witnessing a new birth. The great change is mainly due to the wings. At one stroke they appear to have been suddenly created out of mere triangular stumps. They now cover the abdomen back to its extreme tip.

The full-grown bug is an ugly creature, massive, angulated, exactly one inch in length. (See Plate 1, Fig. 5.) It sits at the extreme tips of the vegetation, clinging to one spot, beak in stem, continuing the persistent gorge. Probably its repulsive appearance protects it, but it also has a powerful weapon in the discharge that